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(71) Applicant(s)  
Cosmic Commercial Services Limited

(Incorporated in Hong Kong)

509 Jubilee Court Centre, 2-18 Lok King Street,  
Fotan, Shatin, New Territories, Hong Kong

(72) Inventor(s)  
Ringo Kwok-Keung Yau  
Thomas Kwok-Wai Cheung

(74) Agent and/or Address for Service  
David Keltie Associates  
Audrey House, Ely Place, LONDON, EC1N 6SN,  
United Kingdom

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UK CL (Edition M ) H4K KOF  
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## (54) High security entry system for a building or car park

(57) Entry systems for a building or car park in which information and commands are relayed via an established communications medium such as a telephone network or LAN, which medium is not dedicated to the entry system but is used for more general communications. The systems comprise an entry set which generates a code eg by dialling to select an occupier set, which after audio and/or video communication of information transmits coded command tones to control door release etc. An image of the visitor may be recorded on a time lapse recorder and the occupier visited, time and date stored eg in CD-ROM for subsequent retrieval upon insertion of a magnetic ID card. An occupier set may be arranged to connect the entry set to other occupier sets in response to an alarm condition. The use of touch screen displays, work stations, recorded responses, voice recognition software, modems and microwave links is described.

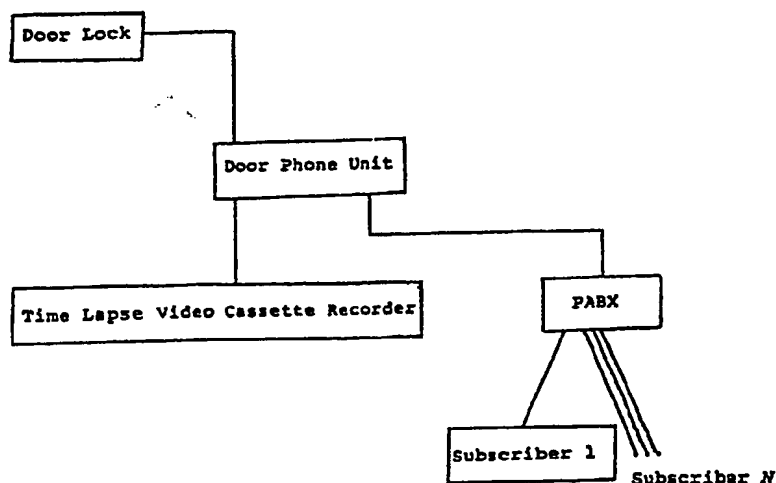


Fig. 1

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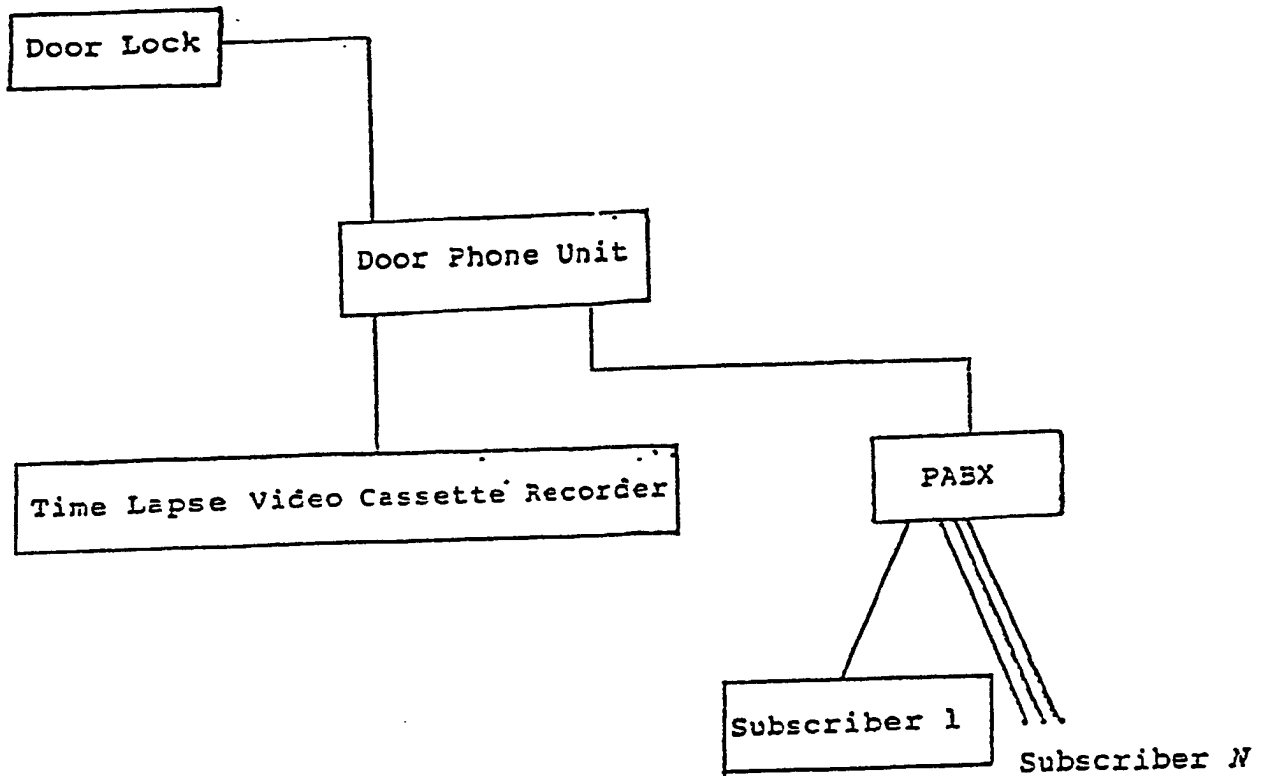


FIG. 1

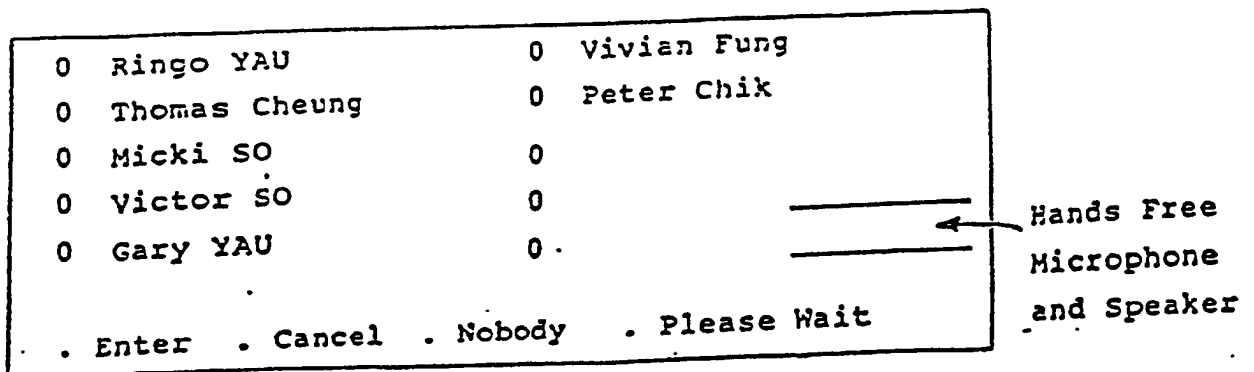


FIG. 2

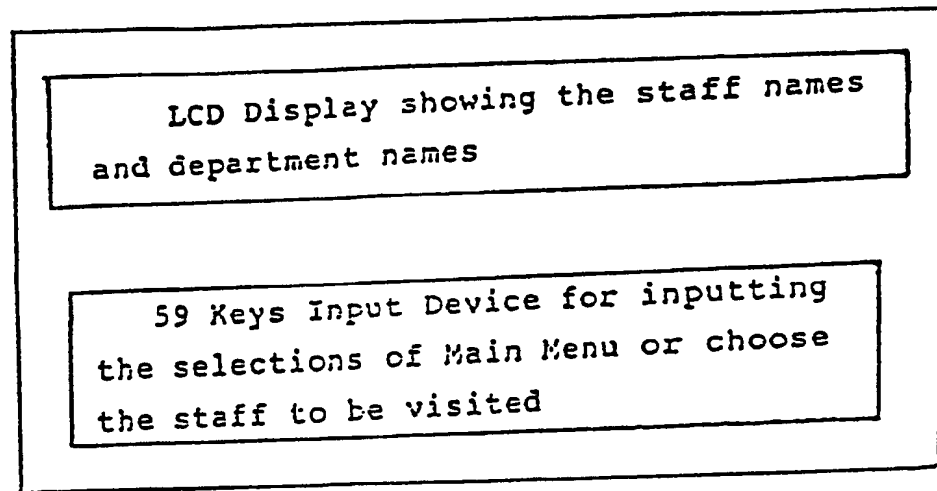


FIG. 3

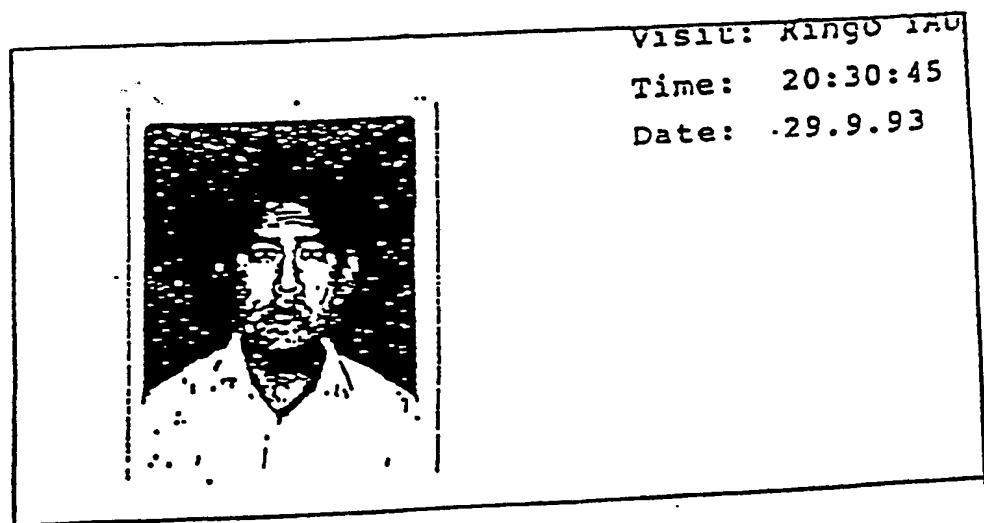


FIG. 4

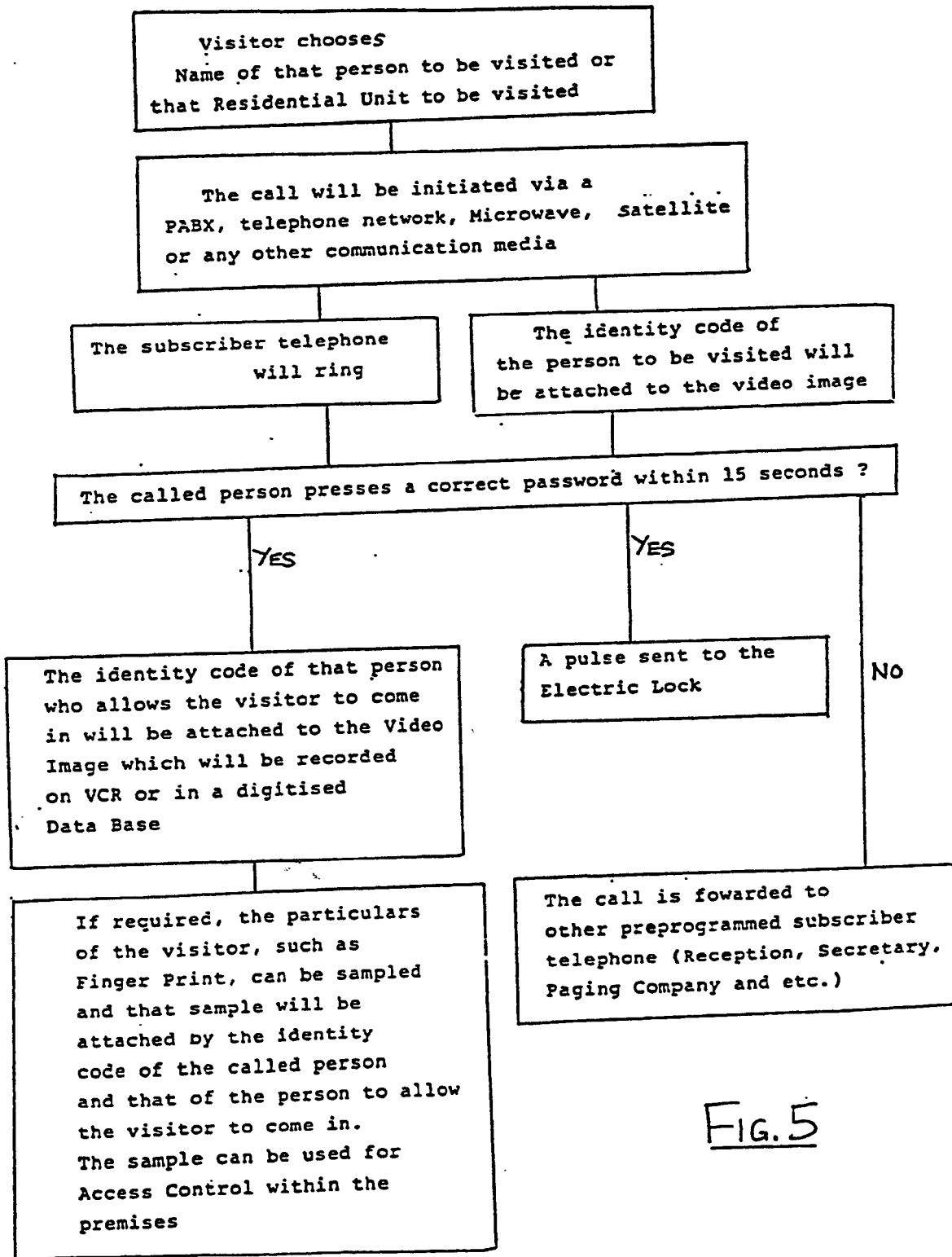


FIG. 5

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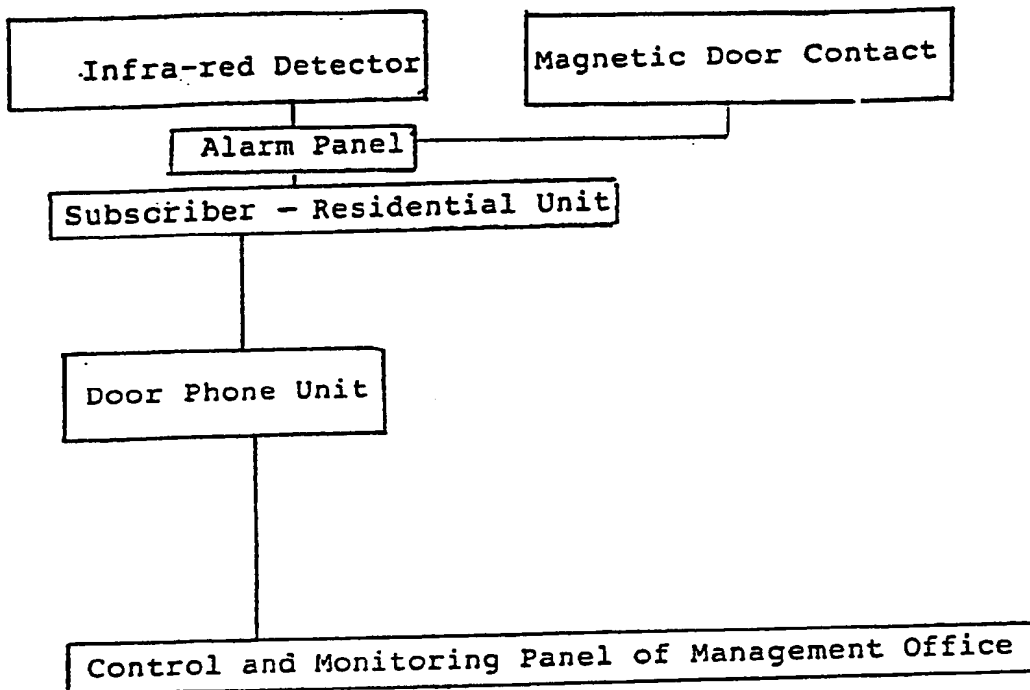


FIG. 6

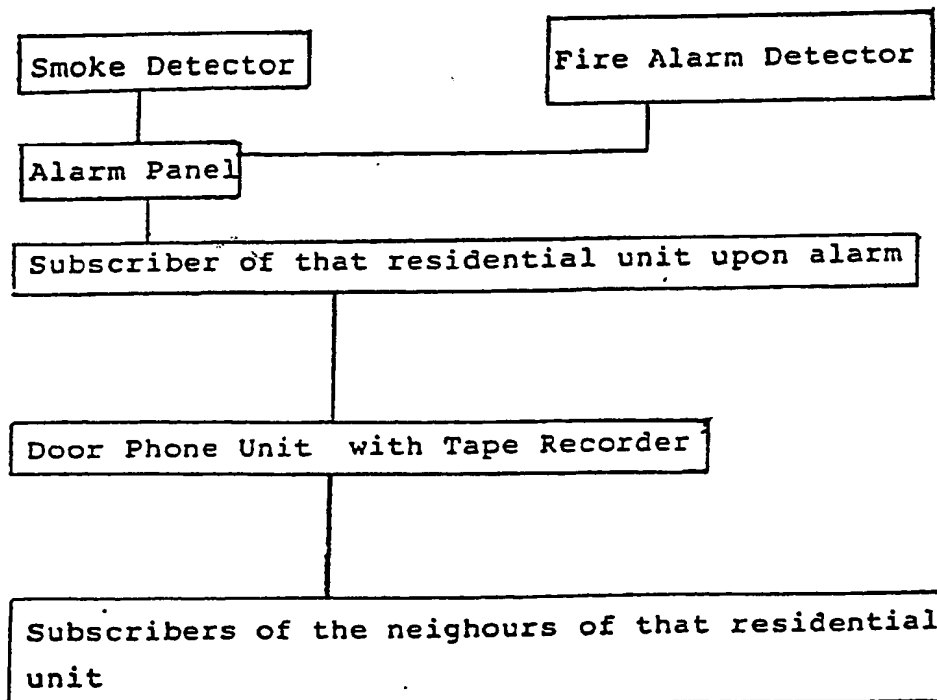


FIG. 7

- A. Department
- C. Reception
- E. Emergency

- B. Name in Alphabetical Order
- D. Security Dept.

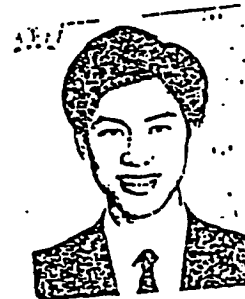


Fig. 8

- A. Personnel Department
- B. Accounting Department
- C. Administration Department
- D. Production Department
- E. Shipping Department

- F. Engineering Department
- G. General Manager Office

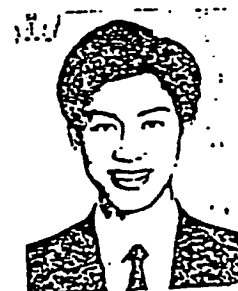


Fig. 9

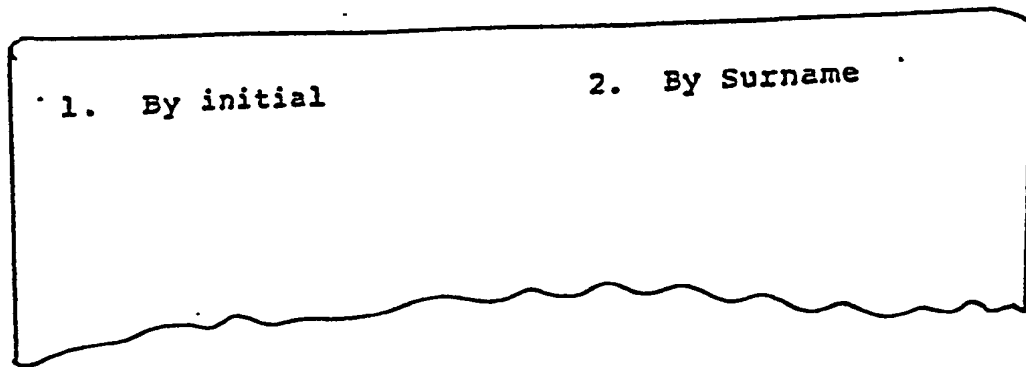


FIG. 10

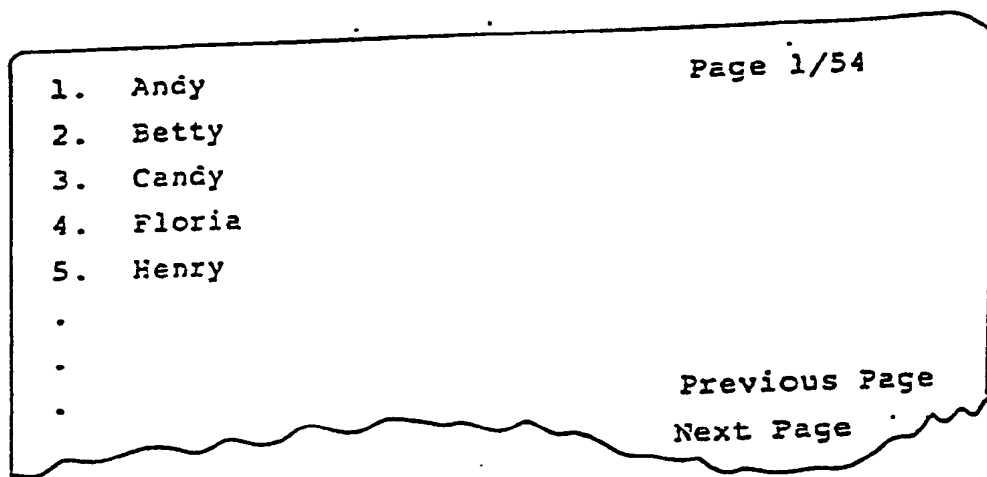


FIG. 11

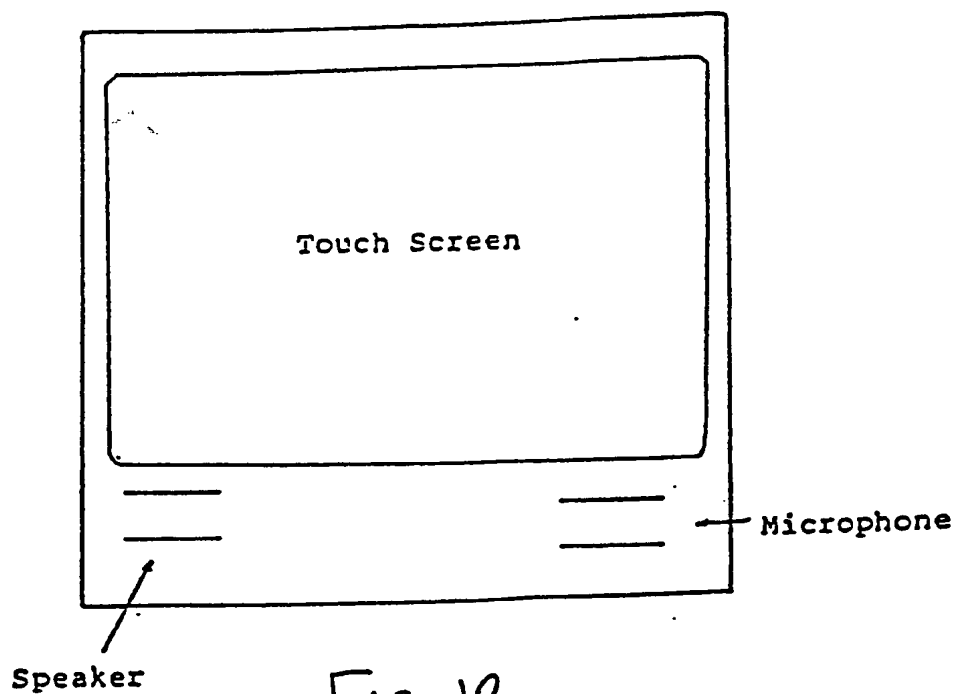
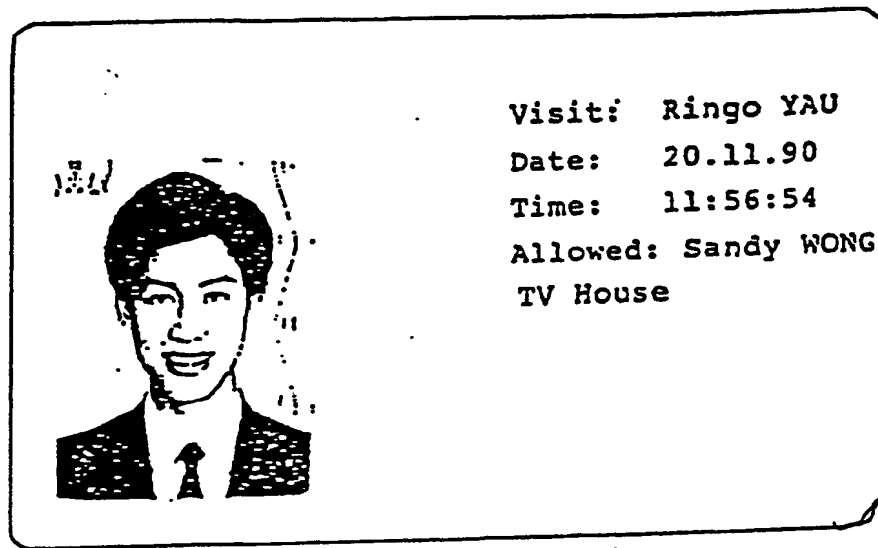
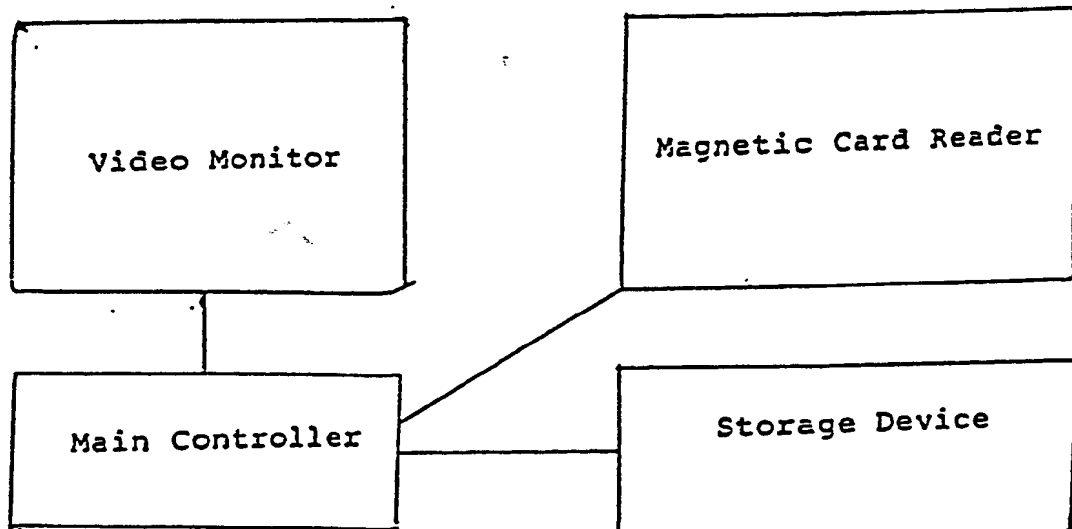
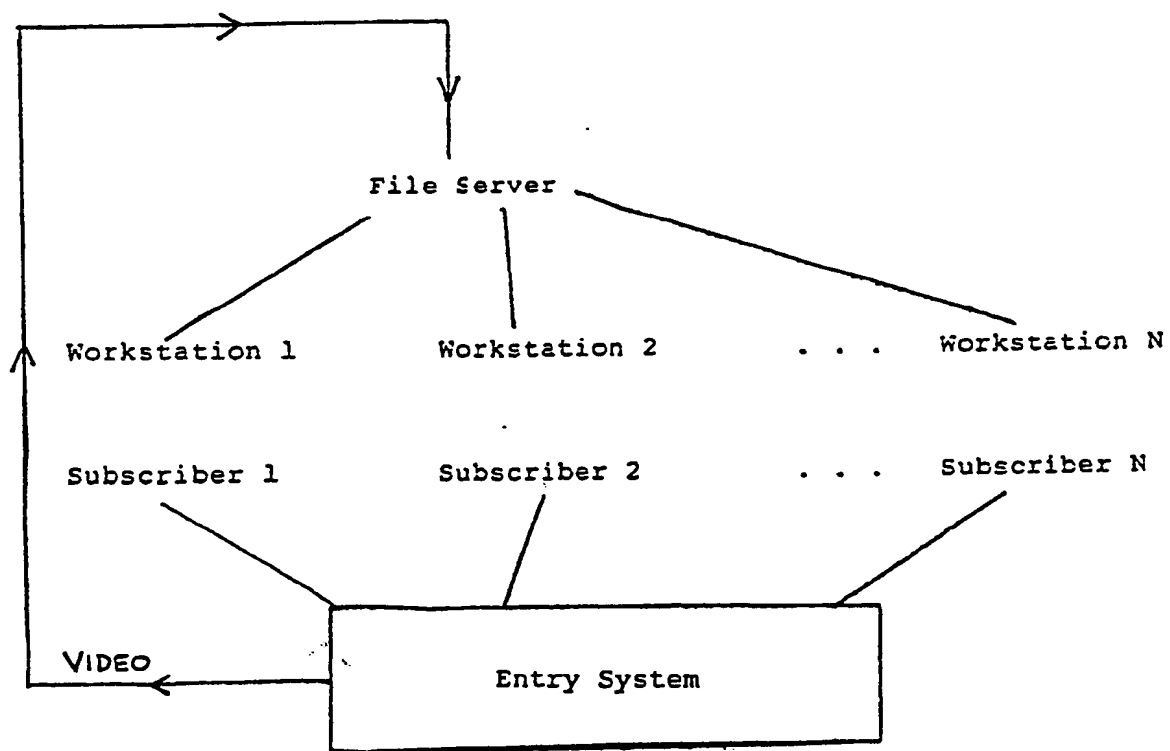


FIG. 12

FIG. 13FIG. 14



FIG. 15

**HIGH-SECURITY ENTRY SYSTEM**

This invention relates to security systems for controlling the movement of persons or vehicles into and out of a space such as a building or a car park. Such security systems will be referred to in this specification as entry systems.

- 5 The control of access to a building is a long-standing problem which has become more acute in these days of rising crime levels. All too easily, unauthorised persons can enter buildings to commit theft or assault, simply by using the entrance normally used by visitors to the building. Further, having committed criminal acts, those persons can readily escape from the building the same way.
- 10 The problem of unauthorised access is suffered by all sorts of buildings, from individual dwellings such as houses and apartments, to commercial premises such as factories and office blocks. However, the problem is particularly severe in buildings comprising several units which share a common outer entrance, such as office blocks and apartments. Accordingly, in such buildings, it is common to employ a security guard
- 15 who watches for visitors and checks to see if they are authorised to enter the building, sometimes using a visitor book to record the visitor's name and other details.

- Unfortunately, security guards are fallible as they may fall asleep, be absent from their post or simply be distracted when an intruder enters the building. Even if the guard asks a visitor the name of the person or company being visited, there is no guarantee that the
- 20 visitor will actually go to that person or company once allowed to pass. Further, if the building has a busy entrance, the guard may simply fail to notice an intruder among the many people that pass by each day. It should also be noted that a guard's wages add greatly to the cost of running a building, and are reflected in increased service charges for the individuals or companies that have premises in the building.

- 25 A cheaper alternative to a guard is an entry system comprising an intercom (having an entry set and at least one occupier set) and a remote-control lock which prevents a visitor

from entering the building until he or she is allowed in by an occupier of the building. More sophisticated systems have a miniature video camera associated with the entry set adjacent the entrance door which captures an image of the visitor's face for display on a small television screen associated with the occupier set in the resident's premises. The  
5 resident can speak to the visitor via the intercom or can identify the visitor from the video image and then, if appropriate, can allow the visitor into the building by releasing the remote-control lock, using a switch situated in the resident's premises.

Intercom or video entry systems such as those described suffer several disadvantages which undermine the security of a building. Commonly, a resident may be tricked into  
10 allowing an unauthorised person into the building or may simply be negligent in checking the identity of visitors to the building. Once allowed in, the errant visitor may roam relatively freely around the building and engage in criminal acts. Unfortunately, if there are several residents in the building, there is little chance of identifying the individual who allowed the unauthorised person into the building.

15 Further, existing entry systems require extensive wiring and may comprise many units of dedicated hardware dispersed around the building; this hardware can be expensive, unreliable and obtrusive.

The present invention has resulted from our efforts to overcome these and other drawbacks of existing security systems. Put broadly, the invention contemplates various  
20 entry systems in which information and commands are relayed via an established communications medium such as a telephone network, which medium is not dedicated to the entry system but is used for more general communications.

From one aspect, the invention resides in an entry system for a building containing one or more occupiers, the system comprising at least one occupier set, the or each occupier  
25 set being identified by and responsive to a code specific to that occupier set, and an entry set having means for selecting an occupier and for generating the code specific to the appropriate occupier set, wherein the entry set and the occupier set are connected to a non-dedicated communications medium for transmission of the code from the entry set

to the occupier set and for transmission of command signals from the occupier set to the entry set.

From another aspect, the invention resides in a method whereby an occupier controls the entry of a visitor to a building, wherein: the visitor selects the occupier on an entry set,  
5 the occupier having an occupier set being identified by and responsive to a code specific to that occupier set; the entry set generates a code specific to the appropriate occupier set to establish communication with that occupier set across a non-dedicated communications medium; the occupier and the visitor communicate across the communications medium; and the occupier sends a command signal from the occupier  
10 set to the entry set, for example to admit the visitor.

Clearly, the use of an existing multi-purpose communications medium such as a telephone network obviates a great deal of dedicated wiring and so reduces the cost of the security system in terms of both hardware cost and installation cost. Further, the reduction in dedicated wiring makes for a neat and tidy installation which can be readily  
15 altered and expanded. However, the potential benefits extend beyond this because the security system may also share other hardware with the existing communications medium. In particular, where the system employs a telephone network, the system may incorporate the resident's telephone; the telephone may be used to communicate with the visitor and to release the remote-control lock. Further, the resident's television set or  
20 computer monitor may be used to display the video image of the visitor.

Where a telephone network is used, as is currently preferred, this could be a public telephone network or a PABX. In a typical application of the invention, a telephone entry set is installed at the entry to a block of residential flats. The entry set enables a visitor to communicate with a resident of the flats by dialling that resident's telephone  
25 which, with its uniquely-numbered telephone line, acts as an occupier set; using that telephone, the resident can speak to the visitor and send a pulse or tone signal to unlock the door. For this purpose, a remote-control door lock is associated with the entry set.

The resident's telephone may ring with different tones to help discriminate calls from

the entry set from ordinary incoming calls from other subscribers.

The entry set suitably has a camera, a microphone and a speaker unit and buttons for the visitor to select the appropriate flat and floor number of the occupier that he or she wishes to visit. By use of a suitable memory, the entry set can automatically dial the  
5 preprogrammed phone number appropriate to the specified residential unit or possibly the occupier's office if nobody is at home or any other telephone numbers preassigned by the occupier according to a sequence.

Once communication has been established between the entry and occupier sets, the image captured by the abovementioned camera associated with (preferably housed in) the entry  
10 set is transmitted while the voice of that visitor is conveyed via the same line of the public telephone network.

A person operating the occupier set in a residential unit can either press a predefined button or sequence of buttons to unlock the door or inform a third party (e.g. a management office inside the building or a security guard in the vicinity) that the visitor  
15 is at the door. The occupier may also trigger the playing-back of any prerecorded sound in any possible recording media (such as a tape cassette recorder or a solid-state voice memory) to pass any desired message on to the visitor.

The persons in the residential unit can also disseminate information via predefined codes using the occupier set. A possible application is that the persons can press predefined  
20 codes to initiate a phone call to the entry set which can then play a recording constituting a fire alarm in the event of a fire.

A pre-programmed code can be used for the occupiers or any authorized persons to enter the building without contacting persons in a residential unit. The occupier set can be connected to any display means (a monitor or a TV etc.) for displaying the image  
25 captured by the entry set.

A fire alarm bell or a burglar alarm bell may also be connected to the entry set and

therefore different alarm status will be broadcasted after different predefined codes have been pressed.

A device for displaying different predefined messages (expressing no answer, talk, come in, select, nobody at home etc.) may also be associated with the entry set.

- 5 Advantageously, all data stored in the memory of the entry set (such as the telephone numbers of occupiers, etc.) can be amended, deleted, updated, retrieved and recorded by a control centre. Conveniently, communication can be established by a phone call from the control centre to the entry set.

- 10 Advantageously, the entry set can be programmed by authorised persons who can input a user code after calling the entry set. The call would be terminated if an unauthorised person tried to dial in. Settable variables may include unlock time, the entry password, the telephone number of the resident or the extension number of the person to be visited if for commercial buildings with a PABX. Programming of the system may also be performed via a remote PC dialling in on the public telephone network.

- 15 If a resident is being forced to open the door, a duress code may be available for him or her to notify a third party, such as other persons in the residential unit, of the alarm status by playing back a relevant recorded tape segment via the entry set.

- 20 If a video cassette recorder (or other video recording equipment) is connected to the equipment for displaying the image of the visitor captured at the entry set, the image received can be recorded upon predefined conditions, such as nobody being at home or no answer from the residential unit for a preprogrammed period of time. In any event, it is envisaged that an indicator will be used to give a message that a visitor has called, thereby keeping the persons in that residential unit fully informed of any visits.

- 25 The persons in a residential unit, after driving their cars into a car park in the building, can press a predefined button sequence on their occupier set (this sequence may possibly include the car's licence number) in order to inform exit control equipment at the car

park (which equipment is connected to the public telephone network) that nobody is authorised to drive those cars out. This may be particularly useful in relation to car parks which have a computerised image comparison system for cars leaving the car park.

5 RS232C ports (or any ports of other communication standards) may be available at a suitable point (a management office, a guarding station etc) for reporting printing. A self-diagnostic program may display a diagnostic code on the entry set or on the equipment in the control centre for easy maintenance.

10 The entry set may also be used as a front-line processor for alarm signals emanating from the occupier set, where the occupier set is connected to alarm sensors, such as motion detectors, magnetic door contacts, glass-break sensors, vibration sensors, smoke detectors etc.. The alarm signals, after being preprocessed by the entry set, may be sent to a control centre and/or a management office over the public telephone network.

15 The occupier set, especially when connected to a video display unit, may also be used to retrieve information from a database in the control centre. A possible application would be to obtain daily local or international news, audibly and/or visually, after pressing predefined codes (which may include a master password, service code number etc.).

20 The camera of the entry set can be connected to a time-lapse video cassette recorder for recording the facial appearance of visitors and the persons to be visited. Since a different password can be assigned for different persons, the name of each person who allows visitors in to the building can be recorded on the video tape along with the time and date. A unique predefined code can be assigned for different residential units and therefore the occupier can retrieve the video image of his own visitors.

25 The facility for recording the identity of the person who allows a visitor into the building helps to encourage a sense of care and responsibility, because there is a risk of being caught and punished if one is careless in allowing all and sundry into the building without adequately checking their *bona fides*.

As different passwords will be assigned to different persons, it would be simple to arrange for a call to be forwarded to one's office if there is nobody at the residential unit, possibly using a call-forwarding facility provided by the telephone company supplying the telephone network. Besides, only authorised persons who have the  
5 passwords can allow the visitors in if the call has been forwarded to one's office. Messages indicating "forwarding to office" or "forwarding to paging company" may be displayed. The system would be still more convenient to use if a unique pager number is assigned to each person.

If the system is employed in an office or a warehouse, the entrance unit can be  
10 connected to a PABX. If the total number of the employees is not too great, all employees' names can be printed on a keypad at the entry set with tens of buttons. Pressing different buttons will relay the call to different persons via the PABX. It is envisaged that all usual features of a PABX may be added to the system.

If the entry system is used in a commercial building or the door phone unit is installed  
15 at the entrance of a company/warehouse, there may be a video monitor placed at the reception so that a receptionist may release the door when the person to be visited is not in. If a person to be visited (e.g. Mr. Ringo Yau) is not available at the expected extension, the call may be forwarded to one of the main telephone lines. The entry system can broadcast a message such as "Ringo Yau, line 3", and then Mr. Yau can  
20 press the button "Line 3" and input a prespecified sequence. If Mr. Yau is not in or the waiting time exceeds a set limit, the receptionist can press a remote door release button or directly talk to the visitor, as the call may be forwarded to the receptionist. Of course, the call may also be forwarded to Mr. Yau's secretary.

If nobody is in the office or residential unit required, the call can be connected to a  
25 paging company which can provide a direct line number to its customers. Thus, if Mr. Yau is not at home, the call can be automatically forwarded to a paging company and then the paging company can ask "Who is calling Mr. Yau?". The visitor may, for example, reply "tell him that Mr. Raymond Chan has arrived - ask him when he will arrive".



In commercial buildings or offices, the name of a member of staff names can be entered in order to retrieve video images of his or her own visitors.

In large buildings, it is preferred that a touch-screen video monitor is employed. Further, 'who' visits 'who' at 'where' and 'when' and 'who' allows the visitor to enter can be  
5 displayed and recorded.

In order that this invention may be more readily understood, reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 is a block diagram of an entry system for use in commercial buildings;

Figure 2 is a layout drawing of a front panel of an entry set for premises containing  
10 small companies;

Figure 3 is a layout drawing of a front panel of an entry set for premises containing large companies;

Figure 4 is a schematic view of a video image recorded on a time-lapse video recorder;

Figure 5 is a flow diagram which illustrates the operation of the system in general terms;

15 Figure 6 is a block diagram showing the configuration of an alarm system which can be connected to an entry system to advise a management office of an emergency or alarm status;

Figure 7 is a block diagram showing smoke/fire alarm broadcasting via an entry system;

Figure 8 is a schematic view of a touch screen to be situated at the entrance of a  
20 commercial building, showing a visitors's video image;

Figure 9 is a schematic view of the touch screen shown in Figure 8, but showing a sub-

menu screen layout;

Figure 10 is a schematic view of the touch screen shown in Figure 8, but showing another sub-menu screen layout;

Figure 11 is a schematic view of the touch screen shown in Figure 8, but showing  
5 another sub-menu screen layout;

Figure 12 is a layout drawing of a front panel of a touch screen visitor system;

Figure 13 is a layout drawing of another touch screen;

Figure 14 is a block diagram showing a system configuration whereby an occupier such as a member of staff can determine who visited, when and where; and

10 Figure 15 is a block diagram of an entry system using a local area network to transmit the video image of a visitor to the person being visited.

Referring firstly to Figure 1 of the drawings, an entry system comprises a door phone unit (an entry set) connected to a communications medium (in this case, a PABX which serves the staff of a business) which has  $N$  subscribers. The subscribers control a door  
15 lock via the PABX and the door phone unit. A time lapse video recorder connected to the door phone unit records the operation of the entry system.

For premises containing a small business, the control panel of an entry system may simply comprise an array of buttons each bearing the name of the associated subscriber, as shown in Figure 2. A hands-free microphone and speaker may be provided on the  
20 control panel as shown, or may be located near the panel.

Premises containing a large business require a more sophisticated control panel for the entry system. Referring to Figure 3, the front panel of the entry set comprises two main areas shown schematically. These are: (i) an LCD display showing staff and department

names and/or menu options; and (ii) a 59-key input device for inputting selections on a main menu, and for choosing staff to be visited. The input device is suitable for alpha-numeric input so that the PABX can connect the line to the person being visited, and the name of that person may also be directly inputted via the input device. The front panel  
5 further includes a microphone and speaker for audio communication.

A video camera associated with the entry set captures a picture of a visitor activating the entry set. The image is also displayed on the appropriate occupier set. If the occupier then enters a unique password or other suitable command, the door is opened and the video image of the visitor is recorded using a time-lapse video recorder. As shown in  
10 Figure 4, this image is recorded with a note of the name of the person being visited (Ringo Yau), and the time and date of the visit. Where the entry system is used in a residential building, the flat/floor number may be displayed instead of the name of the person being visited. The message "Allowed" may be recorded if the password is correct, and the number of attempts may be recorded also.

15 The operation of the system is illustrated in general terms by the flow diagram of Figure 5.

Figure 6 illustrates an alarm system which can be connected to a management office or other monitoring station via the occupier set and the entry set. In an alarm situation, the flat and floor number of the appropriate residential unit may be recorded on computer  
20 and may be displayed on a video monitor or any panel which may indicate the flat and floor number. The residents themselves can input a predefined sequence into their occupier set in an emergency.

As shown in Figure 7, a smoke detector or fire sensor may be connected to the alarm panel in a resident's unit. Upon activation of the fire/smoke alarm, the entry system can  
25 broadcast the alarm situation to the neighbour(s) of that residential unit, for example by calling their occupier sets and playing back a prerecorded tape. The entry set may be connected to multiple telephone lines for such purposes.

Figures 8 to 12 illustrate a touch screen layout of an entry set suitable for use in commercial buildings. The touch screen may be of the pressure sensing, capacitance sensing or resistance sensing type. Any suitable languages can be displayed on the touch screen and may be selected from a menu of possible languages.

- 5 A camera mounted next to the entry set captures an image of the visitor which appears on the screen as shown. The image of that visitor may also be sent to the person to be visited or at least to a reception area where the image can be displayed on a video monitor.

- Figure 8 illustrates a main menu screen. If the visitor chooses 'A' ('Department'), the screen will change to the one shown in Figure 9. If the visitor chooses 'B' ('Name in alphabetical order'), the screen will change to the one shown in Figure 10. If the visitor then selects '1' ('By initial'), the screen will change to the one shown in Figure 11.

Figure 12 illustrates a front panel incorporating the touch screen of Figures 8 to 11, the front panel also including a speaker and a microphone.

- 15 A further touch-screen layout is illustrated in Figure 13. In addition to the name of the person being visited and the date and time of the visit, this screen gives the name of the person - Sandy Wong - that allowed the visitor into the building. The information on this screen can be recorded by any suitable storage device (CD-ROM, video cassette recorder etc.), and there may be an enquiry touch screen for an occupier to find who has visited  
20 him, and when.

- A form of enquiry system is illustrated in Figure 14, which shows a system whereby an occupier such as a member of staff of a company can be shown video images of his or her visitors. The magnetic card reader is just one example of an input device by which the occupier can provide an identification code, conveniently by swiping a personally-coded magnetic card. The main controller, suitably a PC, will then retrieve the images  
25 of that person's visitors from the storage device and display them on the video monitor. Ideally, the microprocessor has already sorted the digitised sound and video data by the

identification code, so that the data can be retrieved promptly.

Figure 15 illustrates a system in which a video image is communicated via a local area network of computer workstations being nodes connected to a file server. Each subscriber (occupier) has a workstation which carries the video image, and a telephone  
5 which deals with audio communication. All workstations receive the digitised video data under background communication mode. There are many software applications which can capture a video image to a predefined window, such as Futurus Team DOS, Windows Combo and Microsoft Windows for Workgroups, Version 3.1 (all Trade Marks acknowledged).

- 10 The connection between the file server and the entry set may be via the public telephone network (both ends with a high-speed modem), or via microwave or other high-bandwidth communication media.

A hands-free microphone and speaker may be provided in the workstations such that digitised sound data together with digitised video images can be sent to and received  
15 from the file server. In any event, as the performance of the PC improves, it is possible that the transmission of both video data and sound data will be effected in real time.

Where the system is computer-based, programming of the system may conveniently be effected by a remote master computer connected to the system via a modem and the public telephone network.

- 20 Many variations are possible without departing from the broad scope of the present invention. For example, in car park applications, video images of vehicles may be monitored and recorded. Voice control is also possible with suitable voice recognition software.

CLAIMS

1. An entry system for a building containing one or more occupiers, the system comprising at least one occupier set, the or each occupier set being identified by and responsive to a code specific to that occupier set, and an entry set having means for  
5 selecting an occupier and for generating the code specific to the appropriate occupier set, wherein the entry set and the occupier set are connected to a non-dedicated communications medium for transmission of the code from the entry set to the occupier set and for transmission of command signals from the occupier set to the entry set.
2. An entry system according to claim 1, wherein the communications medium is a  
10 telephone network.
3. An entry system according to claim 2, wherein the telephone network is a public telephone network or a PABX.
4. An entry system according to claim 2 or claim 3, wherein the occupier set acts as a telephone on the telephone network.
- 15 5. An entry system according to any of claims 2 to 4, wherein the occupier set emits a first signal to indicate that a visitor is using the entry set and a second, different signal to indicate an incoming telephone call.
6. An entry system according to any preceding claim, wherein the entry set includes a microphone and the reply set includes a speaker for audio communication across the  
20 communications medium.
7. An entry system according to claim 6, wherein the entry set further includes a speaker and the reply set further includes a microphone for two-way audio communication across the communications medium.

8. An entry system according to any preceding claim, wherein the entry set includes a video camera and the reply set includes a visual display for video communication across the communications medium.
9. An entry system according to claim 8, wherein the entry set further includes a visual display and the reply set further includes a video camera for two-way video communication across the communications medium.
10. An entry system according to any preceding claim, including means for recording an image of a visitor's face.
11. An entry system according to any preceding claim, including means for recording the time of a visit, optionally including the date of the visit.
12. An entry system according to any preceding claim, including means for recording the occupier set, or the individual, that admits each visitor to the building.
13. An entry system according to any of claims 10 to 12, wherein the recorded information is stored in a memory that is accessible by a plurality of occupiers, the access of each occupier being restricted to information relating to his or her visitors.
14. An entry system according to claim 13, wherein each item of information within the memory is flagged with a code representing the appropriate occupier.
15. An entry system according to any preceding claim, including divert means which, if enabled when a visitor calls, contact the occupier at a specified location other than that occupier's premises.
16. An entry system according to any preceding claim, wherein an occupier operating the occupier set must enter a code in order to transmit a command signal to the entry set.

17. An entry system according to claim 16, wherein the code is unique to the individual operating the occupier set.

18. An entry system according to any preceding claim, wherein the occupier set is responsive to an alarm system within the occupier's premises and communicates an  
5 alarm condition beyond the occupier's premises via the communications network.

19. An entry system according to claim 18, wherein the occupier set communicates the alarm condition by causing the entry set to communicate with other occupier sets.

20. An entry system according to any preceding claim, wherein video and audio signals are transmitted between the entry and occupier units by different types of  
10 communications media.

21. An entry system according to claim 20, wherein audio signals are carried by a telephone network and video signals are carried by a computer network such as a local area network.

22. A method whereby an occupier controls the entry of a visitor to a building, wherein:  
15 the visitor selects the occupier on an entry set, the occupier having an occupier set being identified by and responsive to a code specific to that occupier set; the entry set generates a code specific to the appropriate occupier set to establish communication with that occupier set across a non-dedicated communications medium; the occupier and the visitor communicate across the communications medium; and the occupier sends a  
20 command signal from the occupier set to the entry set to admit the visitor.

23. An entry system, substantially as hereinbefore described with reference to, or as illustrated in, any of the accompanying drawings.

24. A method for controlling the entry of a visitor into a building, substantially as hereinbefore described with reference to, or as illustrated in, any of the accompanying  
25 drawings.



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**Patents Act 1977**  
**Examiner's report to the Comptroller under Section 17**  
**(The Search report)**

Application number  
GB 9325554.5

**Relevant Technical Fields**

- (i) UK Cl (Ed.M)      H4K (KOF)  
(ii) Int Cl (Ed.5)      H04M 11/02 AND H04N 7/18

Search Examiner  
KEN LONG

Date of completion of Search  
16 MARCH 1994

**Databases (see below)**

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) NONE

Documents considered relevant following a search in respect of Claims :-  
1 TO 24

**Categories of documents**

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| <p><b>X:</b> Document indicating lack of novelty or of inventive step.</p> <p><b>Y:</b> Document indicating lack of inventive step if combined with one or more other documents of the same category.</p> <p><b>A:</b> Document indicating technological background and/or state of the art.</p> | <p><b>P:</b> Document published on or after the declared priority date but before the filing date of the present application.</p> <p><b>E:</b> Patent document published on or after, but with priority date earlier than, the filing date of the present application.</p> <p><b>&amp;:</b> Member of the same patent family; corresponding document.</p> |
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Category	Identity of document and relevant passages		Relevant to claim(s)
X	WO 87/00378 A1	(TRELL) see particularly page 1 lines 4 to 20, page 3 lines 16 to 38 and page 9 lines 4 to 18	1 to 9, 16 to 18 and 22
X	US 5046083	(TRELL) see particularly column 1 lines 5 to 14, column 2 lines 19 to 23 column 4 lines 13 to 15 and 30 to 35 and column 5 lines 4 to 7	1 to 3, 6 to 8, 18, 20 to 22
X	US 4764953	(CHERN) see particularly column 1 lines 7 to 13, column 3 lines 11 to 14 column 4 lines 24 to 51, column 5 lines 22 to 29 and column 6 lines 52 to 57	1 to 7, 16, 17 and 22
X	US 4113986	(BELL) see particularly column 1 lines 58 to 68, column 6 line 35 to column 7 line 6, column 9 lines 8 to 12 and column 27 lines 57 to 62	1 to 7, 16, 17 and 22
X	US 3917911	(LESHER) see particularly column 1 lines 10 to 14, column 2 lines 9 to 26 and column 19 lines 33 to 48	1 to 3, 16, 17 and 22

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Continuation page

Category	Identity of document and relevant passages	Relevant to claim(s)
X	<p>US 3816662 (GTE) see particularly column 1 lines 57 to 61, column 2 lines 13 to 22, 29 to 34, 44 to 50 and 63 to 68 and column 12 lines 45 and 46</p>	<p>1 to 8, 16, 20 and 22</p> <p>TC 26 11-19-02</p>

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